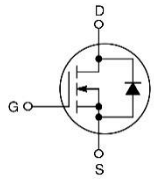
80mΩ, 1200V, Silicon Carbide N-Channel Power MOSFET

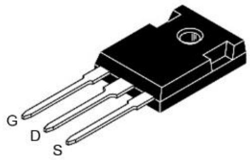
Description

The LXP SEMI LX1C080N120BW silicon carbide Power MOSFET device has been developed using LXP's advanced and innovative 1st generation SiC MOSFET technology. The device features a very low $R_{DS(on)}$ over the entire temperature range combined with low capacitances and good switching performance, which improve application performance in frequency, energy efficiency, system size and weight reduction.

Key Features

- Typ. $R_{DS(on)}$ = 80mΩ @ V_{GS} = 18V
- High speed switching performances
- Low Switching Losses
- 100% Avalanche Tested
- EMI Improved Design
- Very fast and robust intrinsic body diode





TO-247-3

Applications

- DC/DC converter for EV/HEV
- On board charger (OBC)
- Solar Inverters
- Energy Storage Systems
- SMPS (Switch Mode Power Supplies)

Key performance

Parameter	Value	Unit
$V_{DS(T_j=25°C)}$	1200	V
$R_{DS(on), typ(T_j=25°C, I_D=12A, V_{GS}=18V)}$	80	mΩ
$I_{D(Tj=25°C)}$	29	A
$T_{j, max}$	175	ºC

Package Feature

Order code	Marking	Package	Packing
LX1C080N120BW	LX1C080N120B	TO-247-3PIN	Tube

1.Maximum Ratings (T_j=25°C unless otherwise specified)

Parameter		Symbol	Rating	Unit
Drain-Source Voltage		V_{DSS}	1200	V
Gate-Source Voltage		V_{GSS}	-10/+22	V
Gate-Source Voltage Recommended Operation Values		V_{GSS}	-5/+18	V
Gate-Source Transient Voltage (t_p < 1μs, t ≤ 10 hours)		V_{GSS}	-11/+25	V
Continuous Drain Current	T_C = 25ºC	I_D	29	A
	T_C = 100ºC		21	
Pulsed Drain Current (Note 2)		I_{DM}	97	A
Avalanche Energy, Single Pulse (Note 3)		E_{AS}	162	mJ
Avalanche Current, Repetitive (Note 2)		I_{AR}	18	A
Continuous Diode Forward Current		I_S	29	A
Power Dissipation		P_{tot}	183	W
Operating Temperature/ Storage Temperature		T_J	-55~175	ºC

Note:

1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
2. Repetitive Rating: Pulse width limited by maximum junction temperature
3. L = 1mH, I_{AS} = 18A, V_{DD} = 120V, V_{GS} = 18V, R_g = 25Ω, Starting T_J = 25°C

2.Thermal characteristics

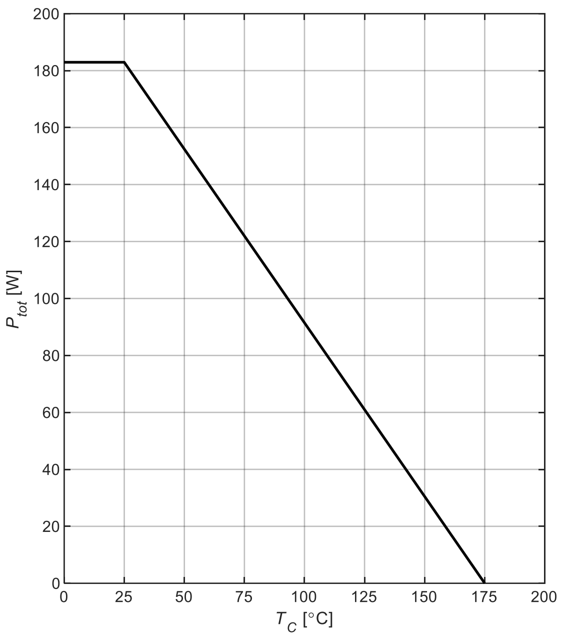
Parameter	Symbol	Value	Unit
Thermal resistance, junction-to-case	R_{thJC}	0.82	°C/W
Thermal resistance, junction-to-ambient	R_{thJA}	49	°C/W

3.Electrical Characteristics (T_j=25°C unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Statistic Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS} = 0 V, I_D = 100 μA	1200	1500		V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 1200 V, V_{GS} = 0 V		1	10	μA
Gate-Source Leakage Current	I_{GSSF}	V_{GS} = 22 V, V_{DS} = 0 V			100	nA
	I_{GSSR}	V_{GS} = -10 V, V_{DS} = 0 V			-100	nA
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 5 mA	2.1	2.8	3.5	V
Static Drain-Source On-Resistance	$R_{DS(on)}$	V_{GS} = 18 V, I_D = 12 A		80	105	mΩ
		V_{GS} = 18 V, I_D = 12 A, T_j =150 ºC		110		
		V_{GS} = 18 V, I_D = 12 A, T_j =175 ºC		125		
		V_{GS} = 15 V, I_D = 12 A		110	145	
		V_{GS} = 15 V, I_D = 12 A, T_j =150 ºC		125		
		V_{GS} = 15 V, I_D = 12 A, T_j =175 ºC		135		
Gate Resistance	R_G	f = 1 MHz，open drain		3		Ω
Dynamic Characteristics						
Input Capacitance	C_{ISS}	V_{GS} = 0 V V_{DS} = 800 V f = 1 MHz		1730		pF
Output Capacitance	C_{OSS}			65		
Reverse Transfer Capacitance	C_{RSS}			5		
Gate to Source Charge	Q_{gs}	V_{DS} = 800 V V_{GS} = -5 to 18 V I_D = 12 A		30		nC
Gate to Drain Charge	Q_{gd}			14		
Gate Charge Total	Q_g			68		
Switching Characteristics						
Turn-on delay time	$T_{d(on)}$	V_{DD} = 800 V, I_D = 12 A, R_G =2.4 Ω, V_{GS} = -5/+18 V		14		ns
Rise time	T_r			26		
Turn-off delay time	$T_{d(off)}$			26		
Fall time	T_f			15		
Turn-on switching energy	E_{on}			230		μJ
Turn-off switching energy	E_{off}			45		
Reverse Diode Characteristics						
Diode Forward Voltage	V_{SD}	V_{GS} = -5 V, I_{SD} = 12 A		4.1		V
		V_{GS} = -5 V, I_{SD} = 12 A, Tj=175 ºC		3.6		
Reverse Recovery Time	t_{rr}	V_R = 800 V, I_F = 12 A, di/dt =1000 A/μs		14		ns
Reverse Recovery Charge	Q_{rr}			50		nC
Peak Reverse Recovery Current	I_{rrm}			8		A

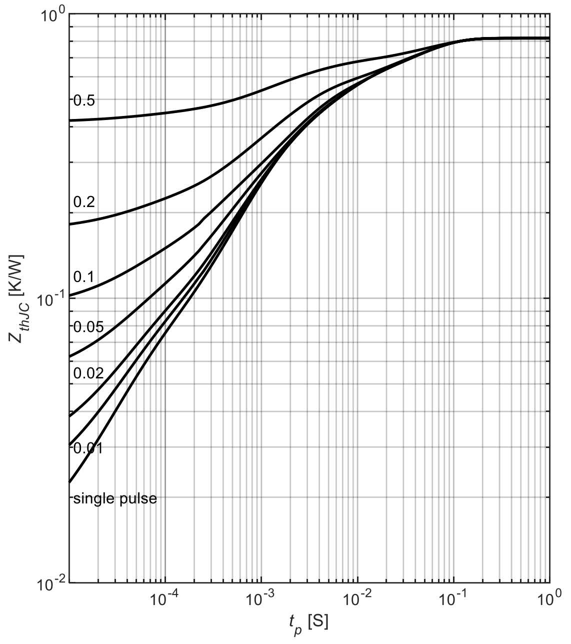
4.Electrical characteristic curves

Figure 1: Power dissipation



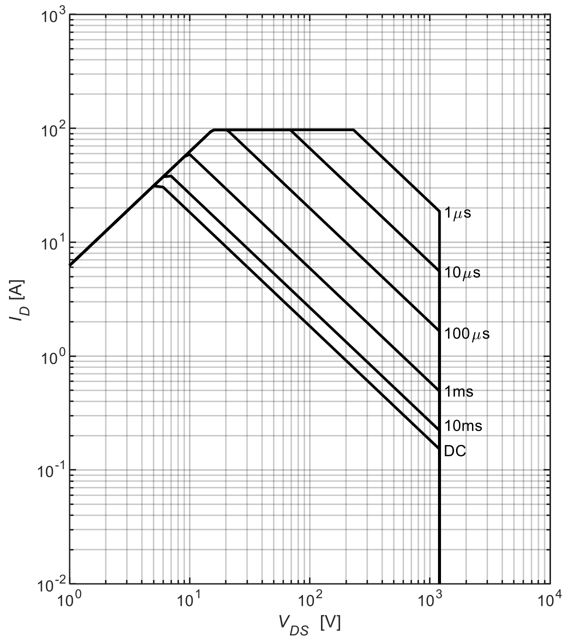
$P_{tot}=f(T_c)$

Figure 2: Transient thermal impedance



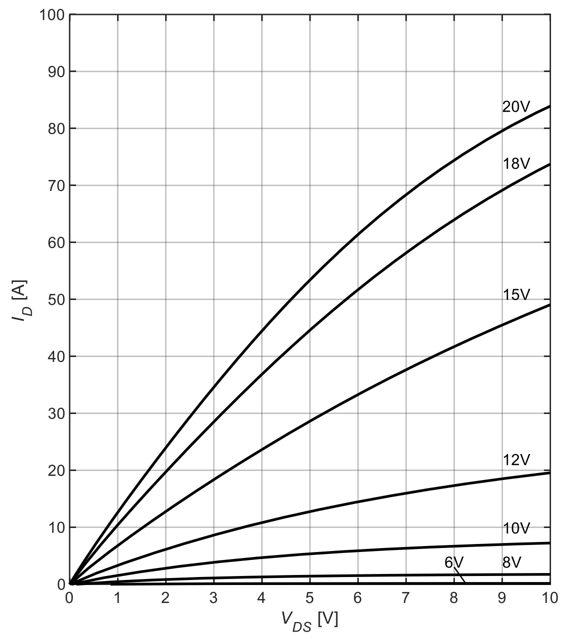
$Z_{(thJC)}=f(t_p)$; parameter: $D=t_p/T$

Figure 3: Safe operating area



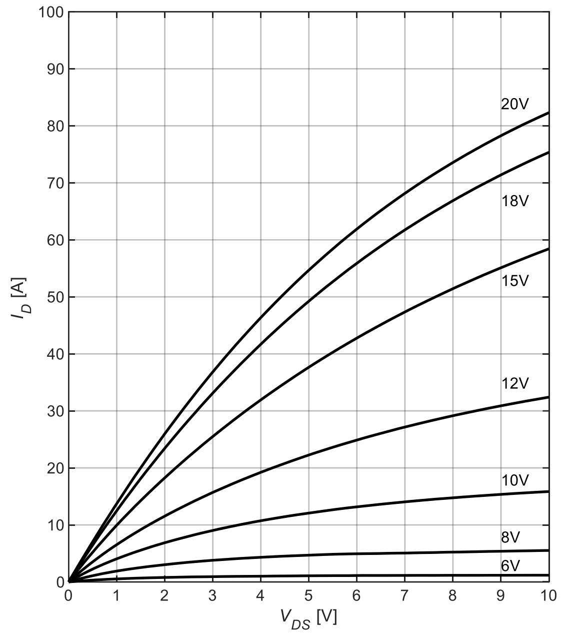
$I_D=f(V_{DS})$; $T_c=25℃$; $V_{GS}>7.5V$; parameter t_p

Figure 4: Typ. output characteristics



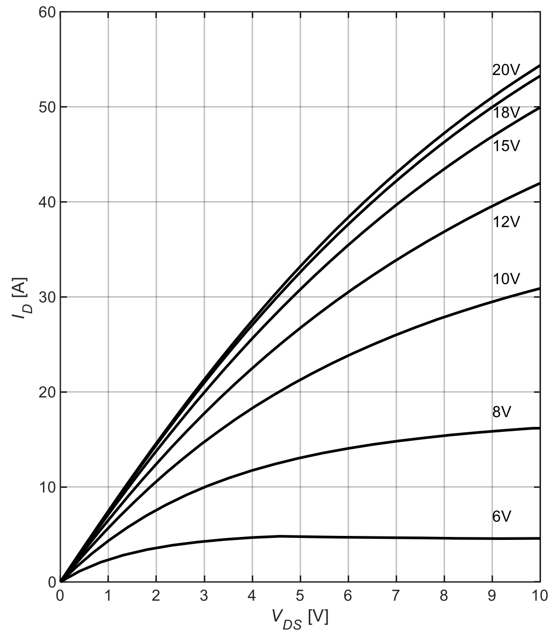
$I_D=f(V_{DS})$; $T_j=-55℃$; parameter: V_{GS}

Figure 5: Typ. output characteristics



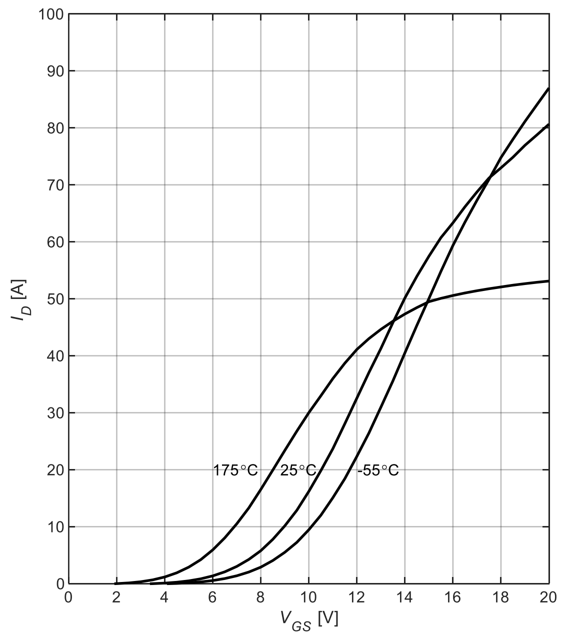
I_D=f(V_{DS}); T_j=25℃; parameter: V_{GS}

Figure 6: Typ. output characteristics



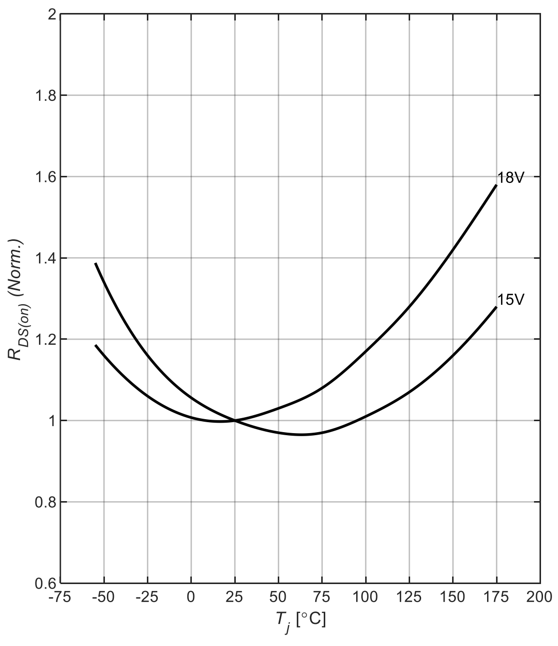
I_D=f(V_{DS}); T_j=175℃; parameter: V_{GS}

Figure 7: Typ. transfer characteristics



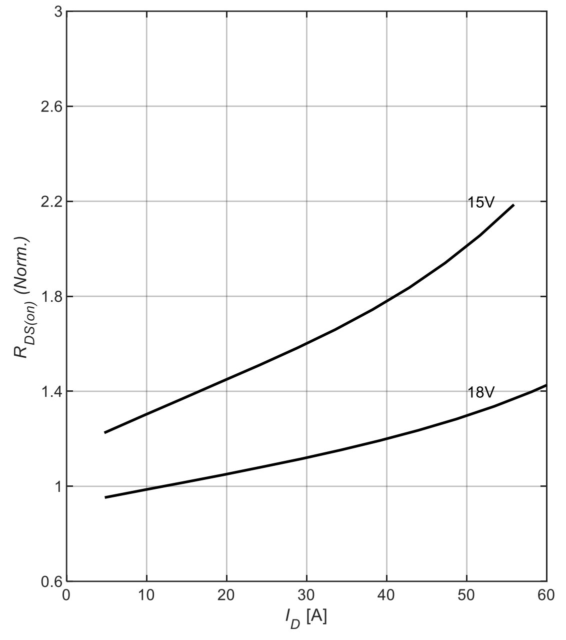
I_D=f(V_{GS}); V_{DS}=10V; parameter: T_j

Figure 8: Norm. Drain-Source On-State Resistance



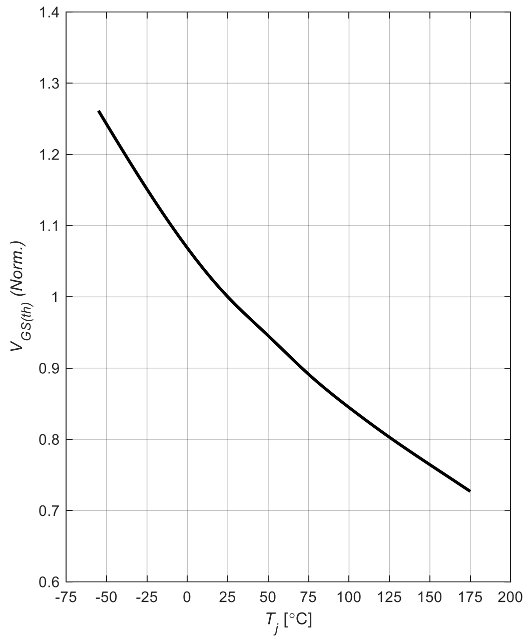
$R_{DS(on)}$=f(T_j); I_D=12A; parameter: V_{GS}

Figure 9: Norm. Drain-Source On-State Resistance



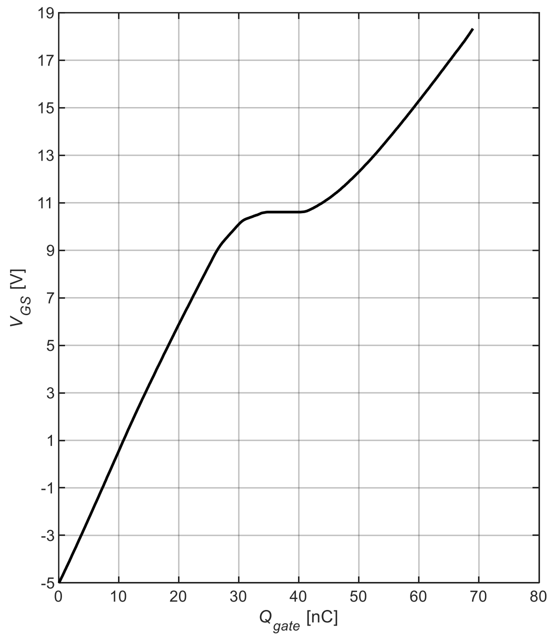
$R_{DS(on)}=f(I_D)$; $T_j=25$℃; parameter: V_{GS}

Figure 10: Norm. gate threshold voltage



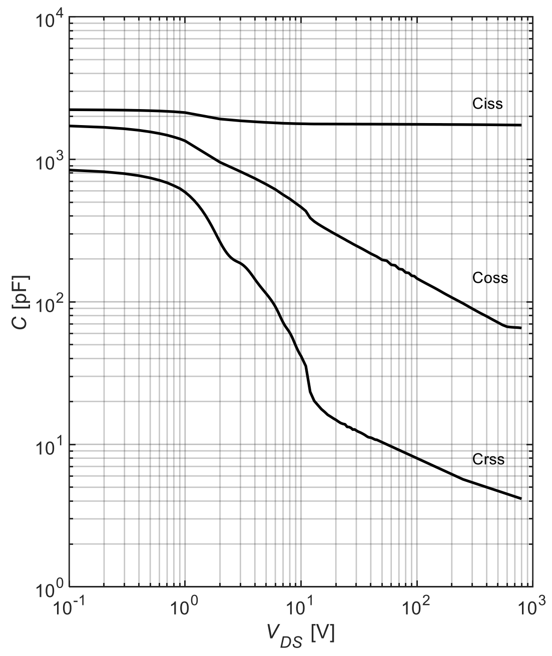
$V_{GS(th)}=f(T_j)$; $V_{DS}=V_{GS}$, I_D =5mA

Figure 11: Typ. gate charge



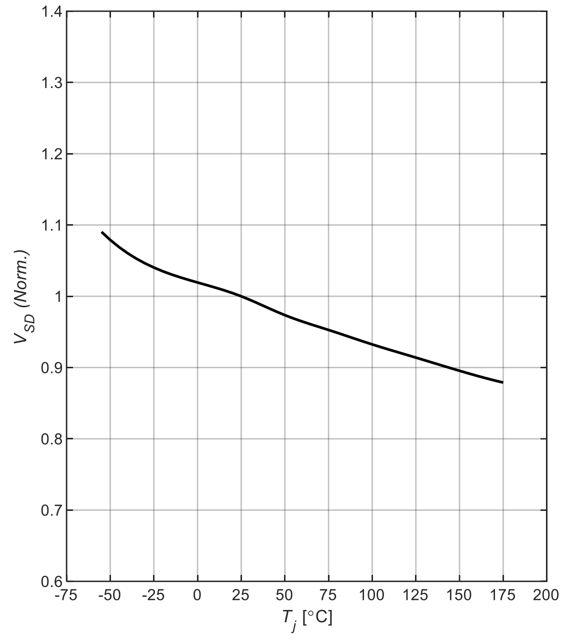
$V_{GS}=f(Q_{gate})$, V_{DS}=800V, I_D=12A pulsed

Figure 12: Typ. capacitances



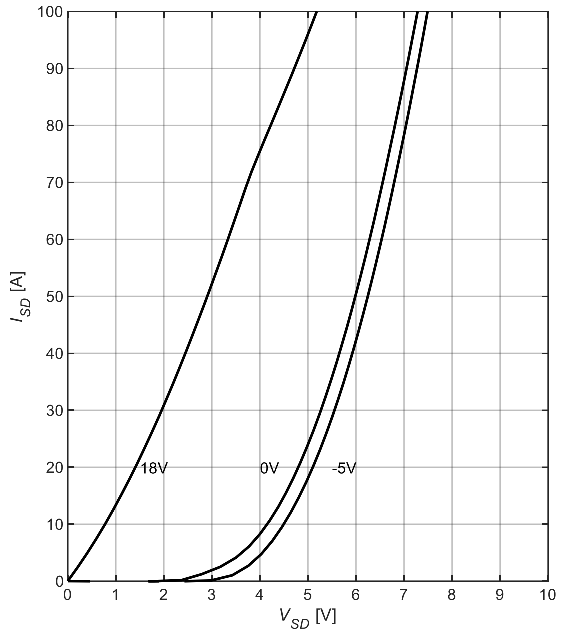
$C=f(V_{DS})$; $V_{GS}=0$; f=1MHz

Figure 13: Norm. reverse diode forward voltage



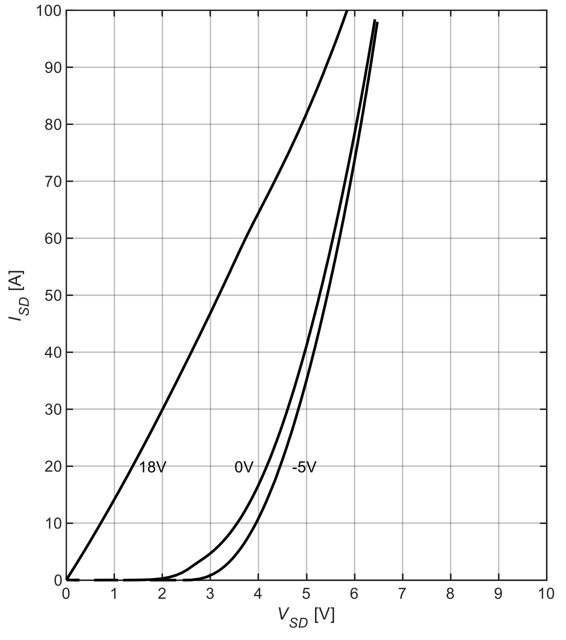
V_{SD}=f(T_j); I_{SD}=12A; V_{GS}=-5V

Figure 14: Typ. reverse conduction characteristics



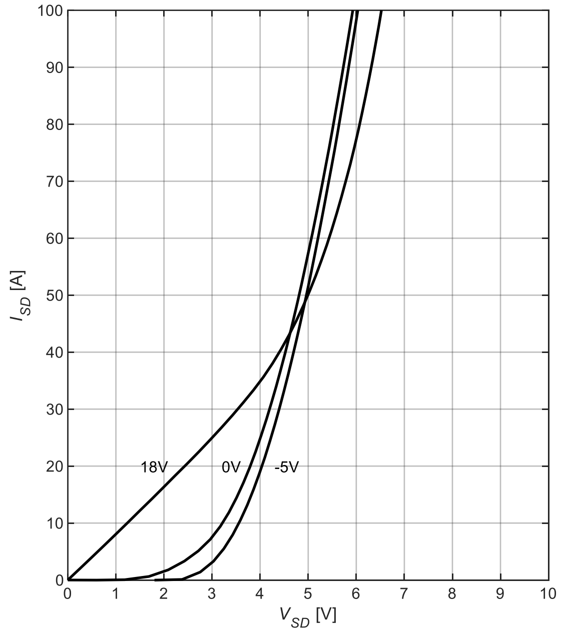
I_{SD}=f(V_{SD}); T_j=-55℃; parameter: V_{GS}

Figure 15: Typ. reverse conduction characteristics



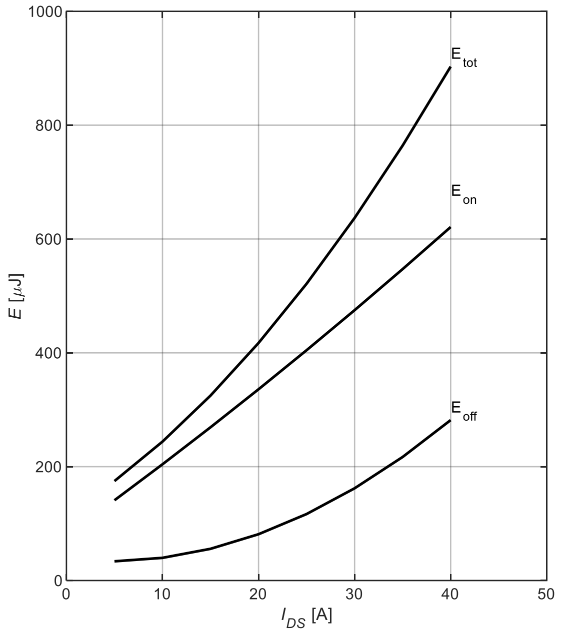
I_{SD}=f(V_{SD}); T_j=25℃; parameter: V_{GS}

Figure 16: Typ. reverse conduction characteristics



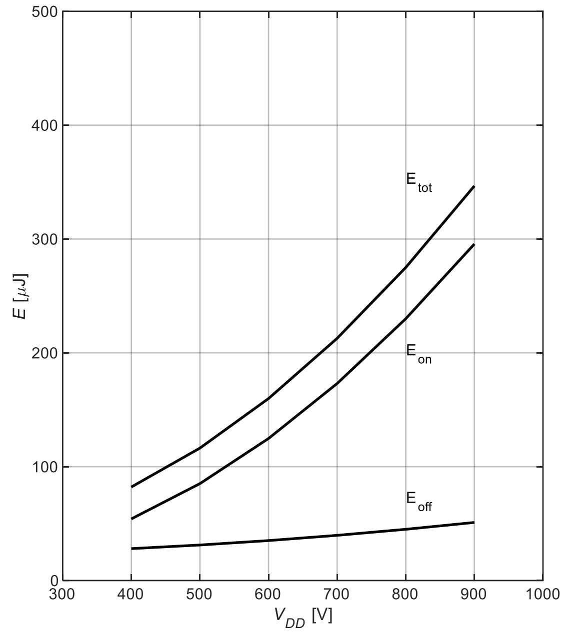
I_{SD}=f(V_{SD}); T_j=175℃; parameter: V_{GS}

Figure 17: Typ. switching energy losses



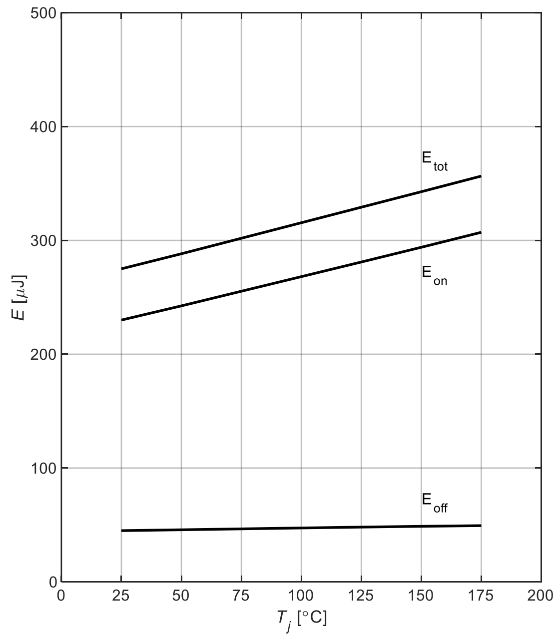
E=f(I_{DS}); V_{DD}=800V; V_{GS}=-5/+18V; R_G =2.4Ω; T_j= 25°C

Figure 18: Typ. switching energy losses



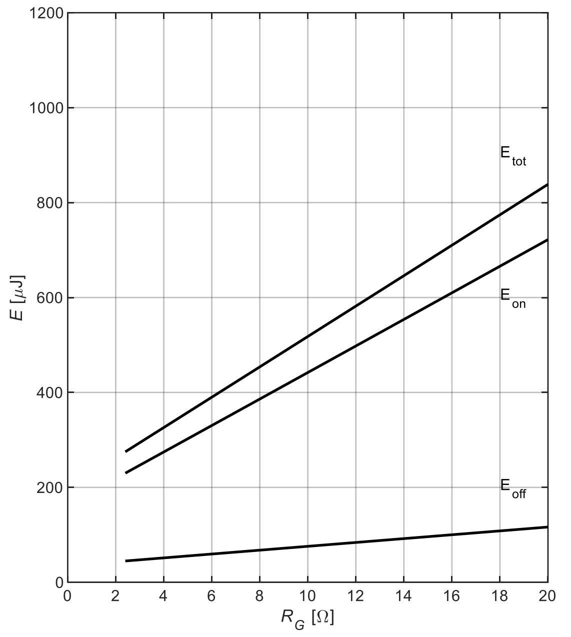
E=f(V_{DD}); V_{GS}=-5/+18V; R_G =2.4Ω; I_D=12A

Figure 19: Typ. switching energy losses



E=f(T_j); V_{DD}=800V; V_{GS}=-5/+18V; R_G =2.4Ω; I_D=12A

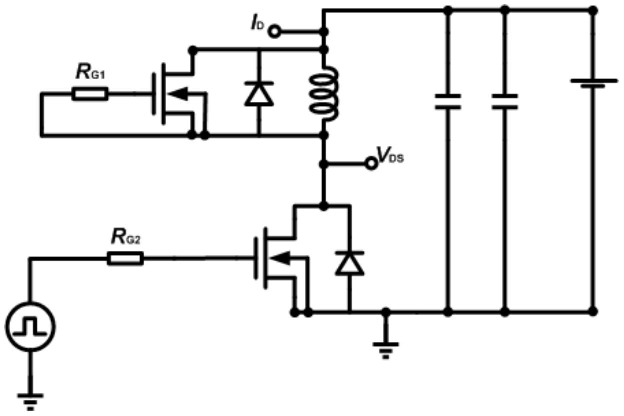
Figure 20: Typ. switching energy losses

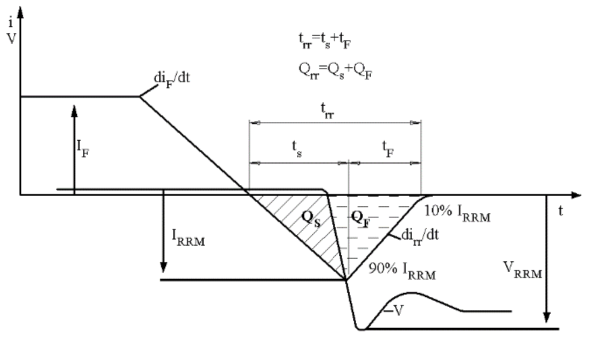


E=f(R_G); V_{DD}=800V; V_{GS}=-5/+18V; I_D=12A

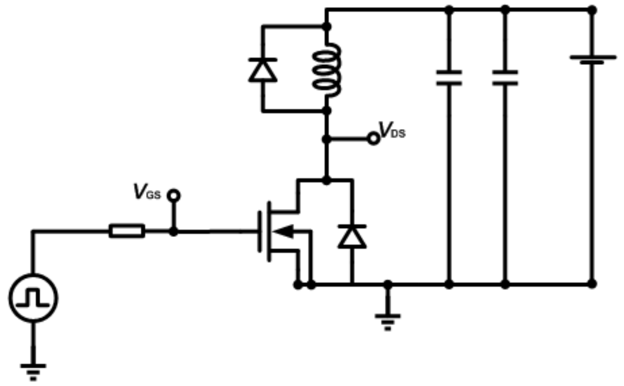
5.Test Circuits

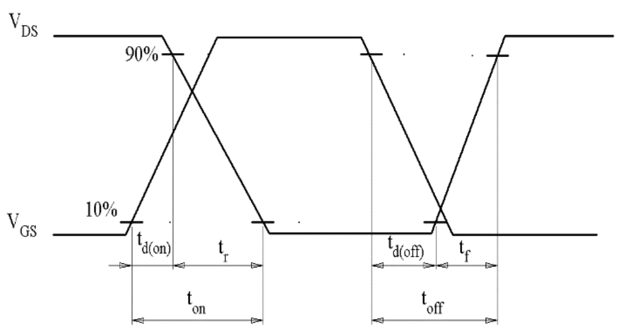
1) Test circuit and waveform for diode characteristics



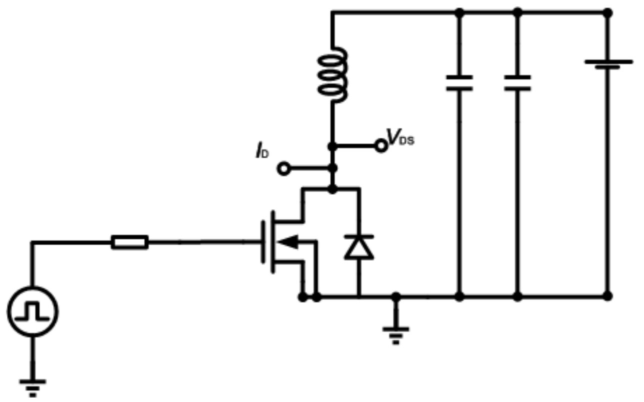


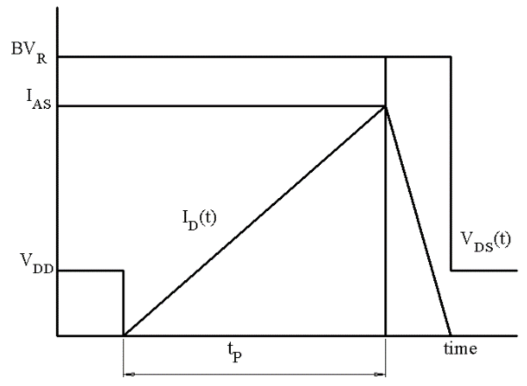
2) Switch time test circuit



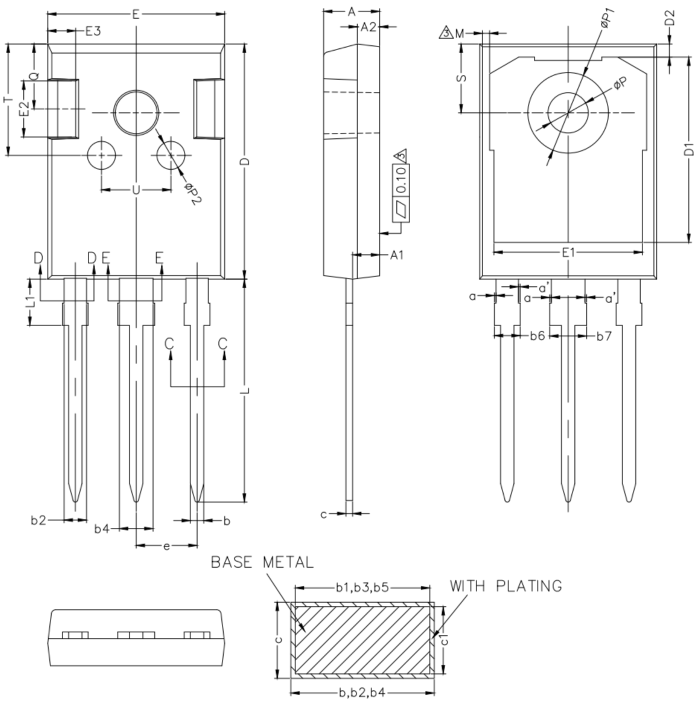


3) Unclaimed inductive switching test circuit & waveforms





6.Package outline dimensions



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	4.90	5.00	5.10
A1	2.31	2.41	2.51
A2	1.90	2.00	2.10
a	0	–	0.15
a'	0	–	0.15
b	1.16	–	1.26
b1	1.15	1.2	1.22
b2	1.96	–	2.06
b3	1.95	2.00	2.02
b4	2.96	–	3.06
b5	2.95	3.00	3.02
b6	–	–	2.25
b7	–	–	3.25
c	0.59	–	0.66
c1	0.58	0.60	0.62
D	20.90	21.00	21.10
D1	16.25	16.55	16.85
D2	1.05	1.20	1.35
E	15.70	15.80	15.90
E1	13.10	13.30	13.50
E2	4.90	5.00	5.10
E3	2.40	2.50	2.60
e	5.34	5.44	5.54
L	19.80	19.92	20.10
L1	3.95	4.13	4.30
M	0.35	–	0.95
P	3.50	3.60	3.70
P1	7.00	–	7.40
P2	2.40	2.50	2.60
Q	5.60	–	6.00
S	6.05	6.15	6.25
T	9.80	–	10.20
U	6.00	–	6.40

7.Revision History

Revision	Description	Date
1.0	Initial version	2023/12/06

IMPORTANT NOTICE

For further information on applications, products and technologies, please contact LXP SEMI office.

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